Dynamic Hurricane Season Prediction Experiment with the NCEP CFS CGCM

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Outline

- Description of the CFS experiment
- Datasets Used
- Analysis of tropical storm statistics
  - Focus on the northern hemisphere basins
  - Statistics and performance evaluation
- Summary

Hurricane season prediction experiment with T382 CFS

1. One of the FY08/09 CTB internal projects - collaborative effort between the NCEP CPC and EMC

2. AGCM - 2007 operational NCEP GFS in T382/L64 resolution
   LSM - Noah LSM
   OGCM - GFDL MOM3

3. All runs initialized with NCEP/DOE R2 and NCEP GODAS. Initial conditions at 0Z, Apr. 19-23 for 1981-2008. Forecasts extended to December 1.

4. Tropical cyclone detection and tracking method based on Carmago and Zebiak (2002)

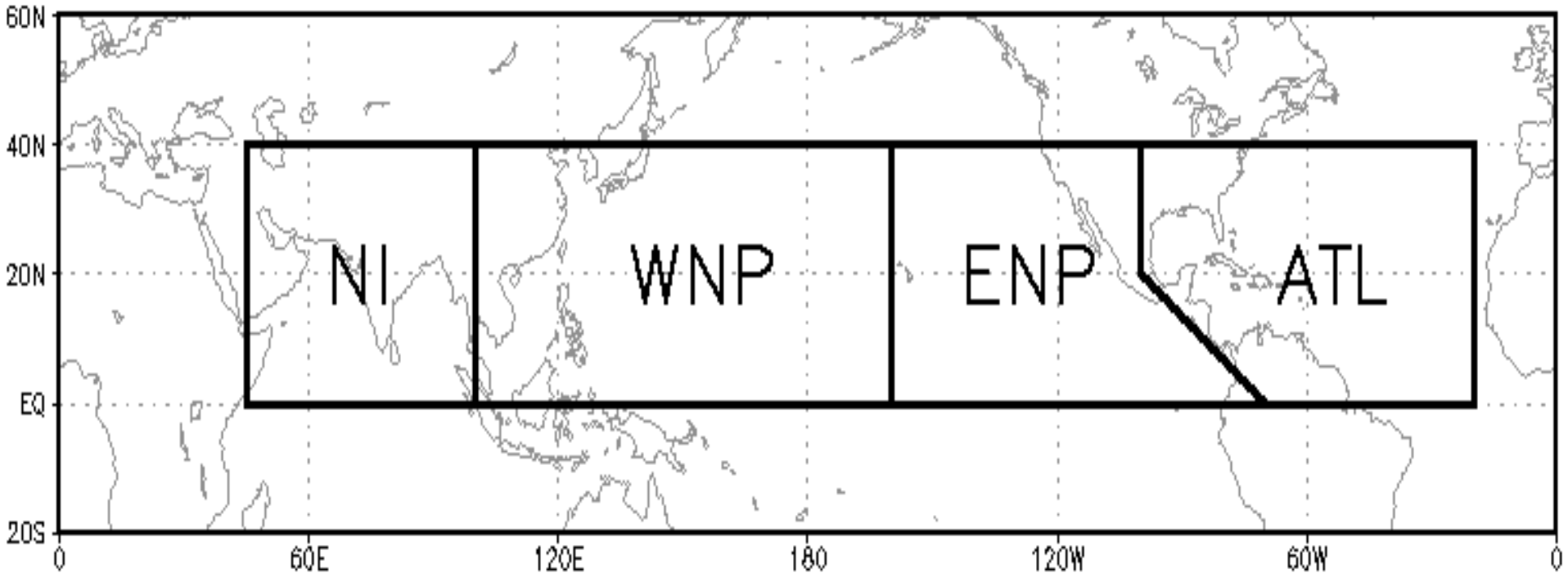
Datasets

- CFS hindcasts at T382
  - April 19th-23rd initial conditions
    - Output at every 6 hours
    - 1981-2008, 28 years
    - Appropriate ICs for CPC operational Hurricane Season Outlook issued in mid-May
- Observations from the HURDAT and JTWC Best Track Dataset
  - Tropical depressions and subtropical storms are not included in storm counts.

CPC Hurricane season outlook for the Atlantic and Eastern North Pacific basins

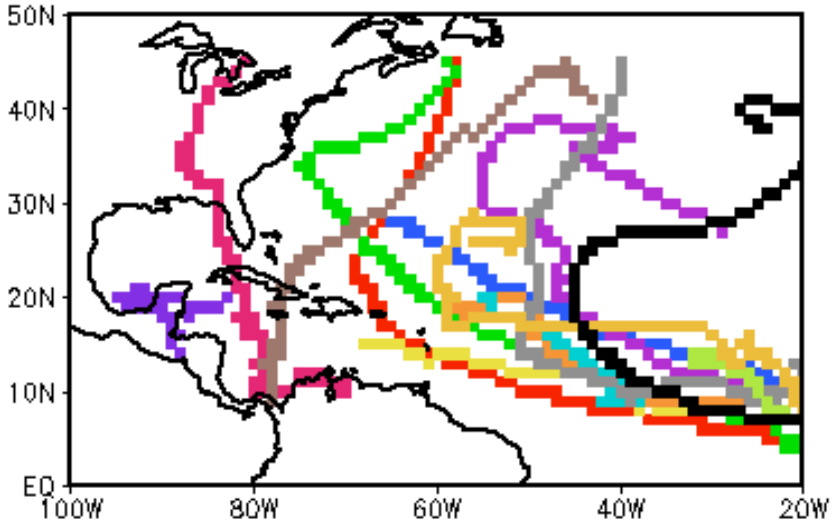
1. Probabilistic season types - above, near and below normal
2. Ranges in the number of named storms, hurricanes and major hurricanes
3. Range in the ACE index

Four NH Ocean Basins

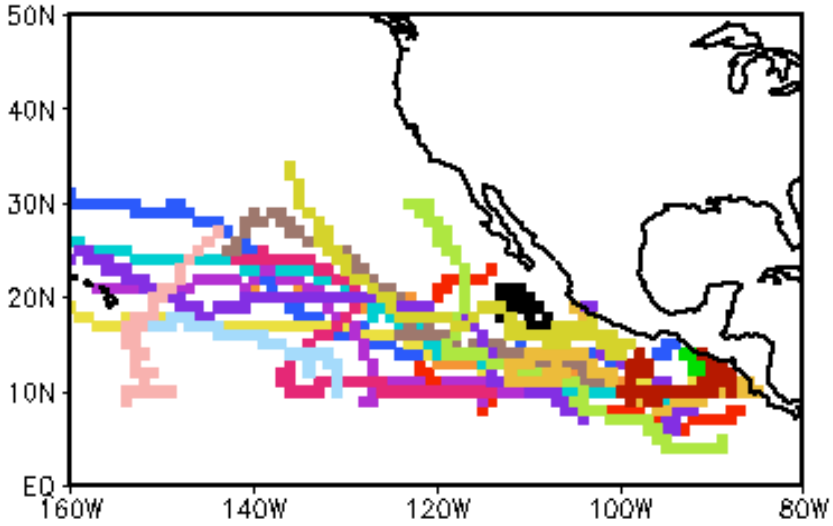


Examples of Storm Tracks for 4 NH Basins

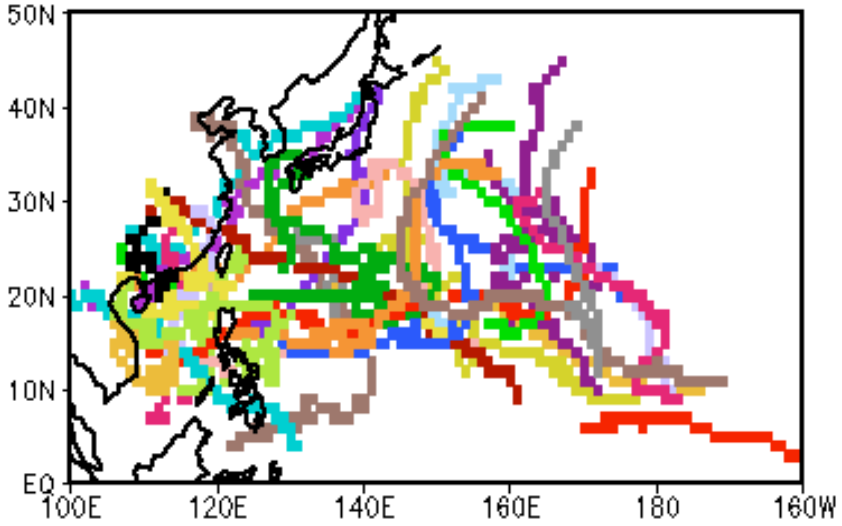
Atlantic



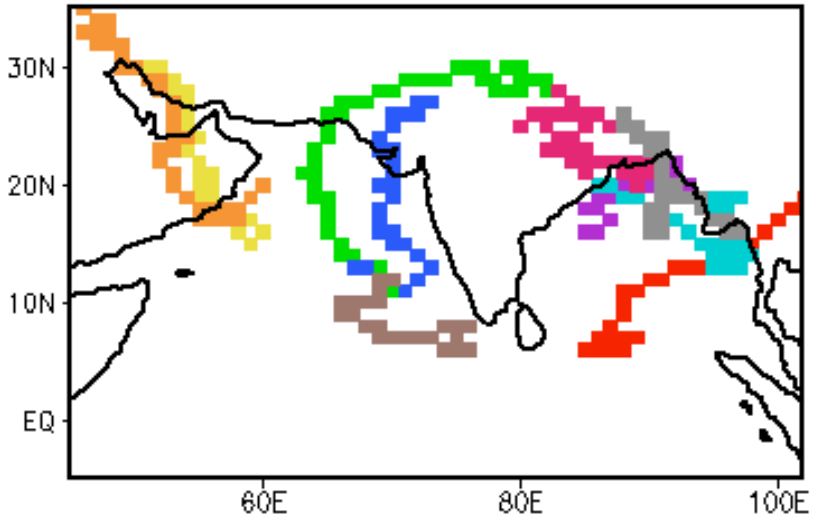
Eastern North Pacific



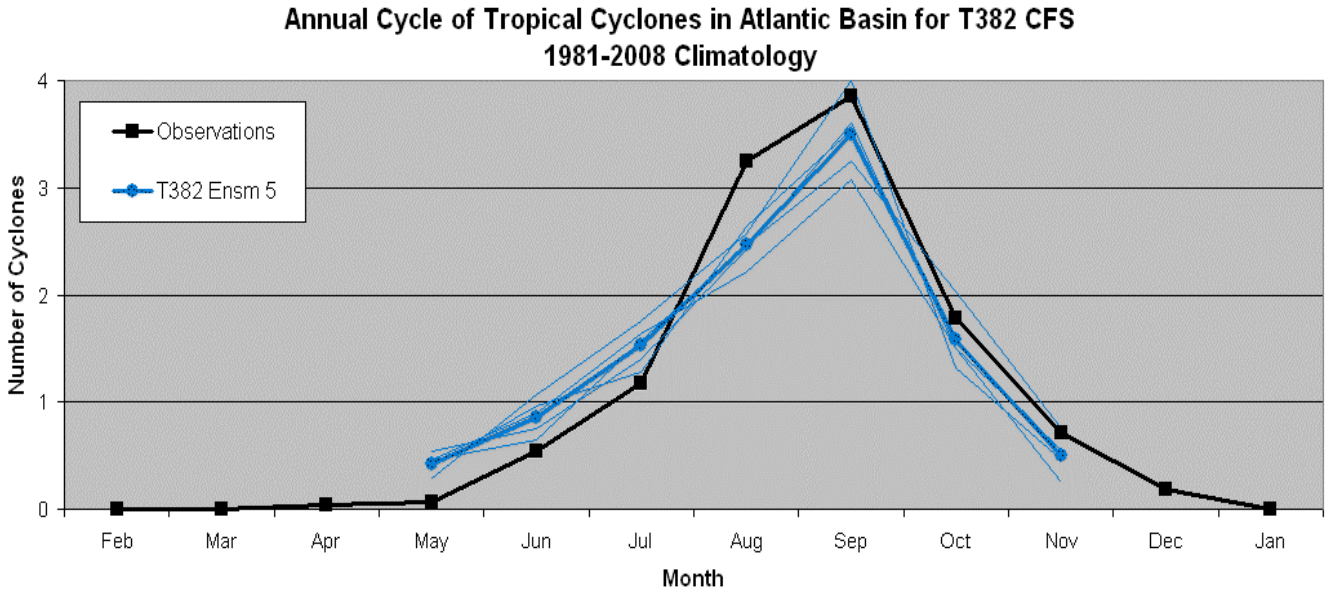
Western North Pacific

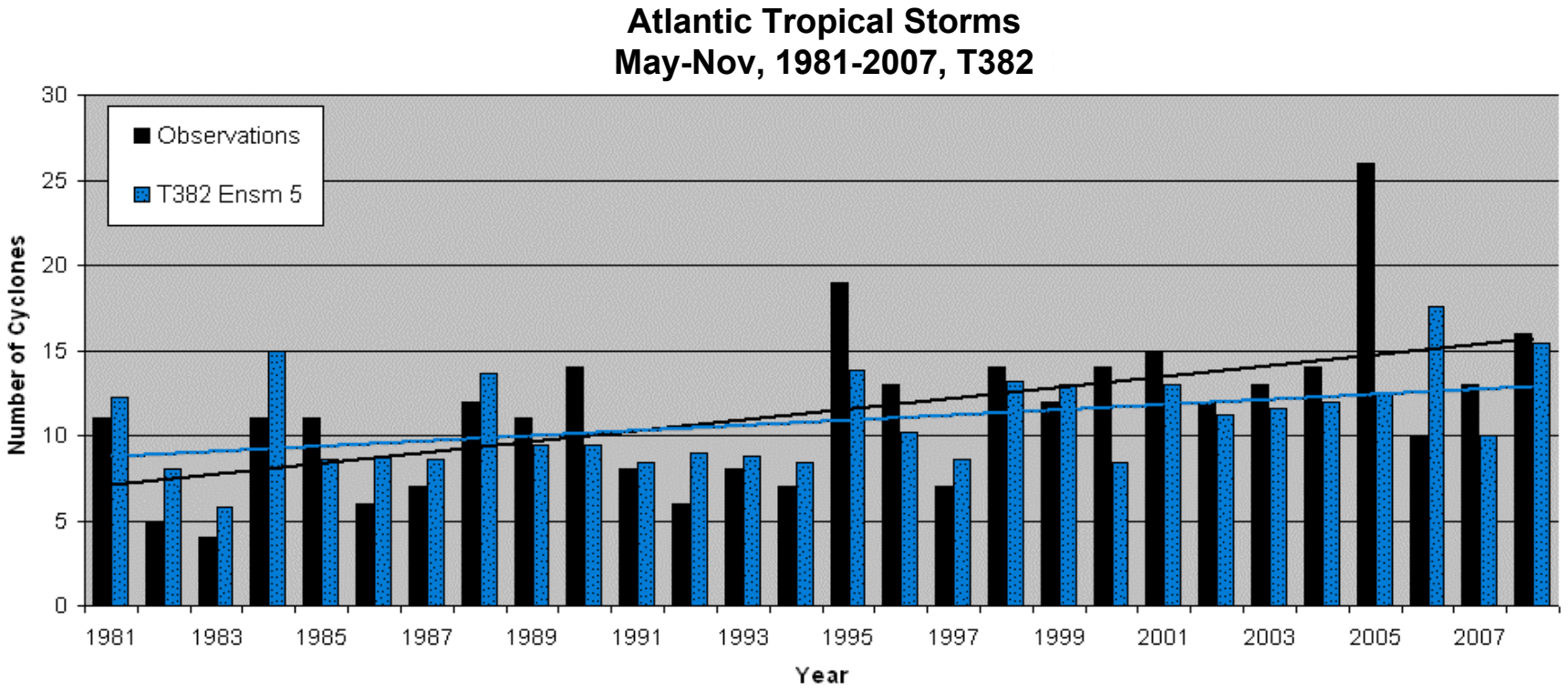


North Indian

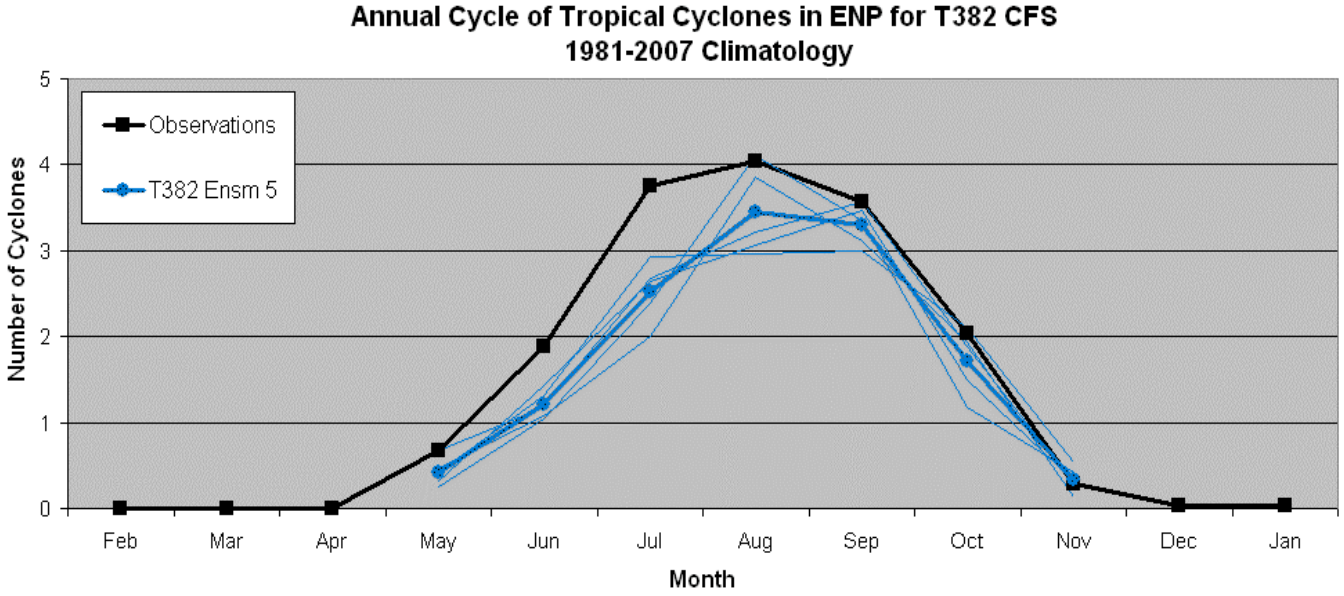


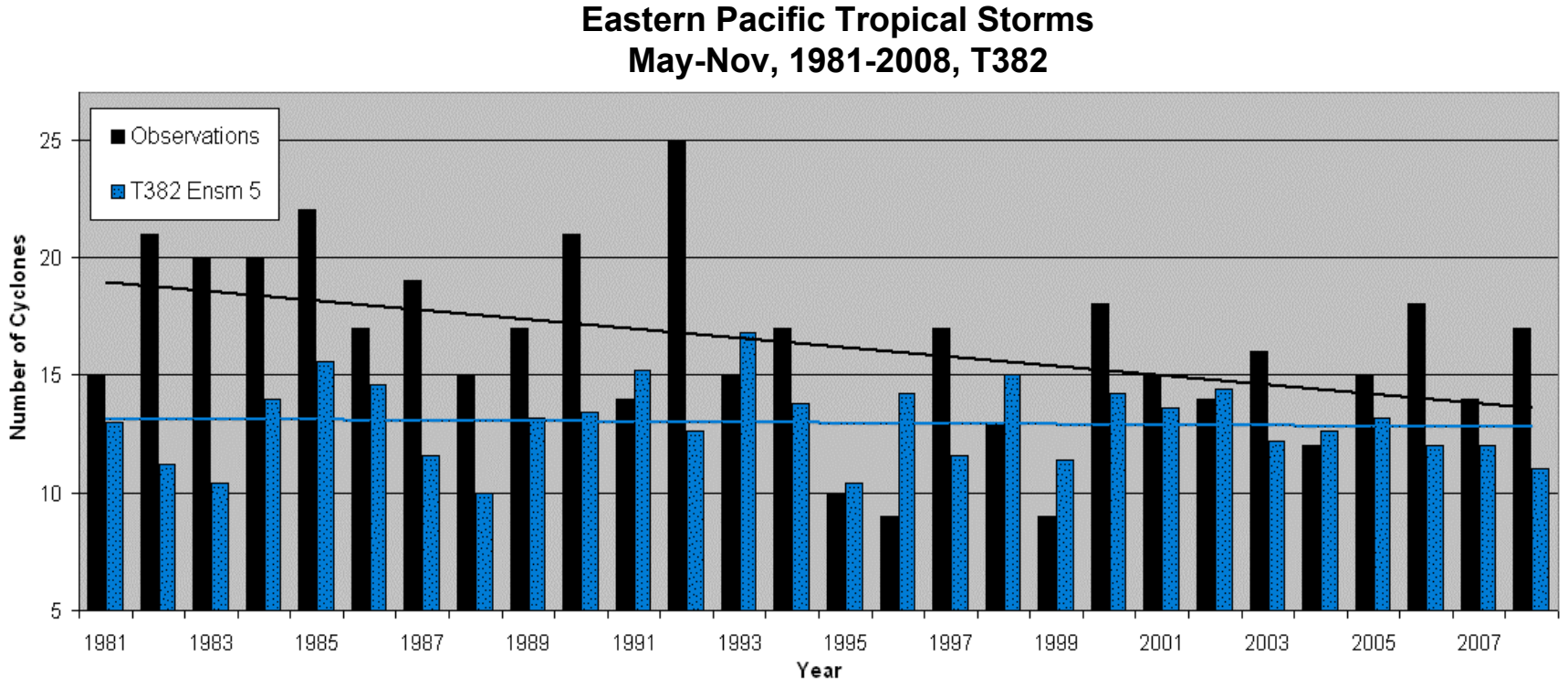
Atlantic Basin



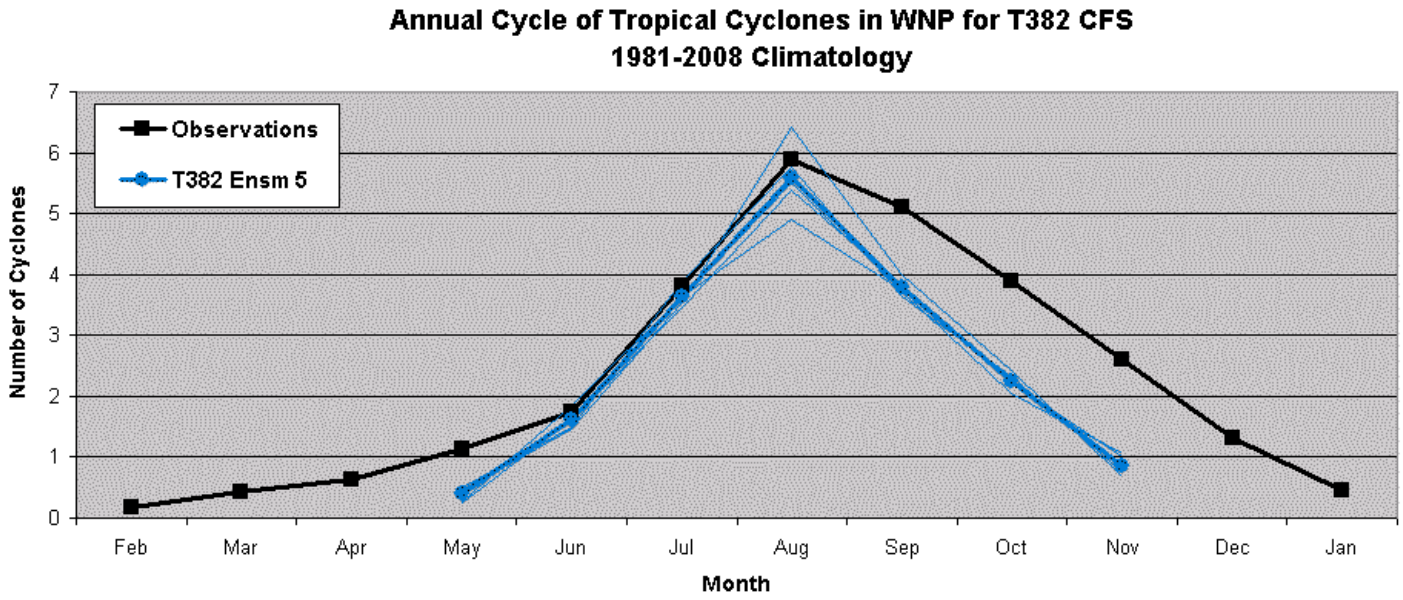


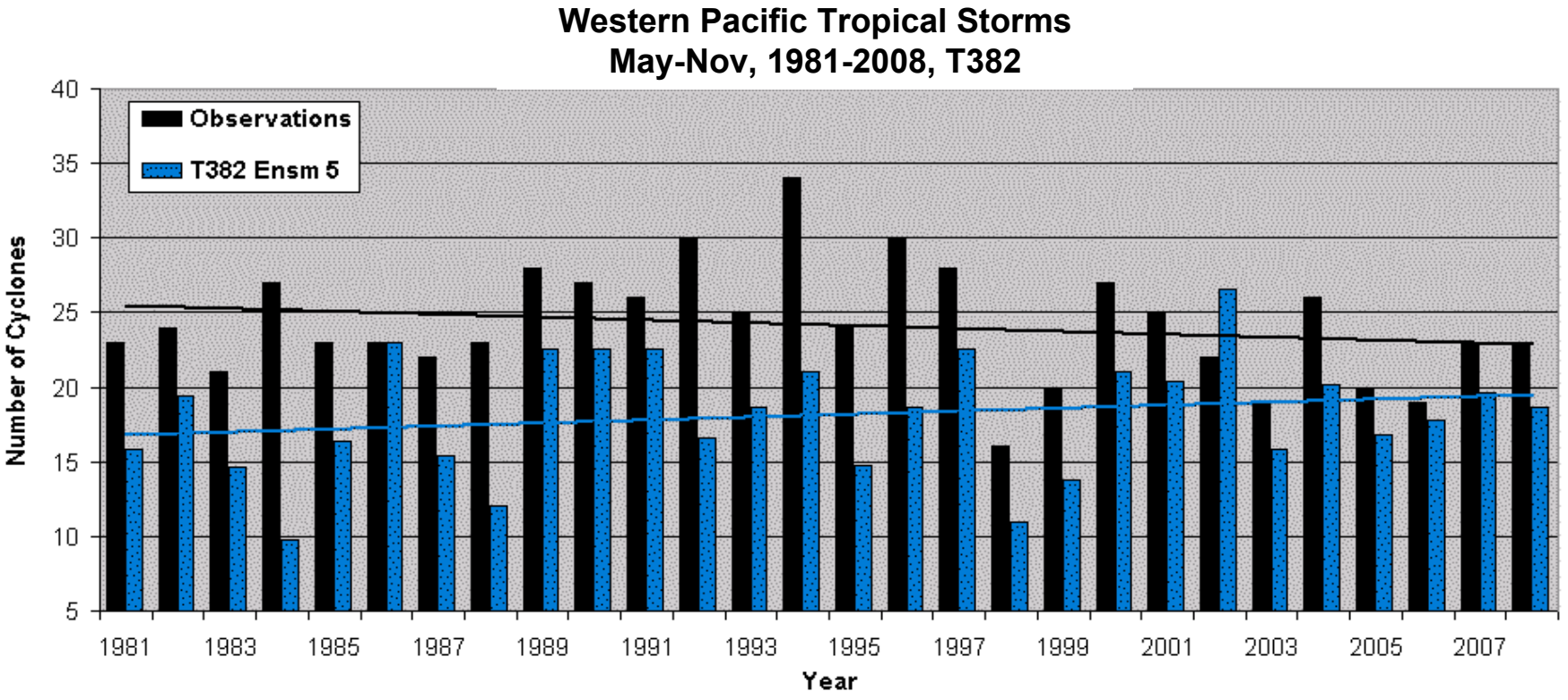
Eastern Pacific Basin



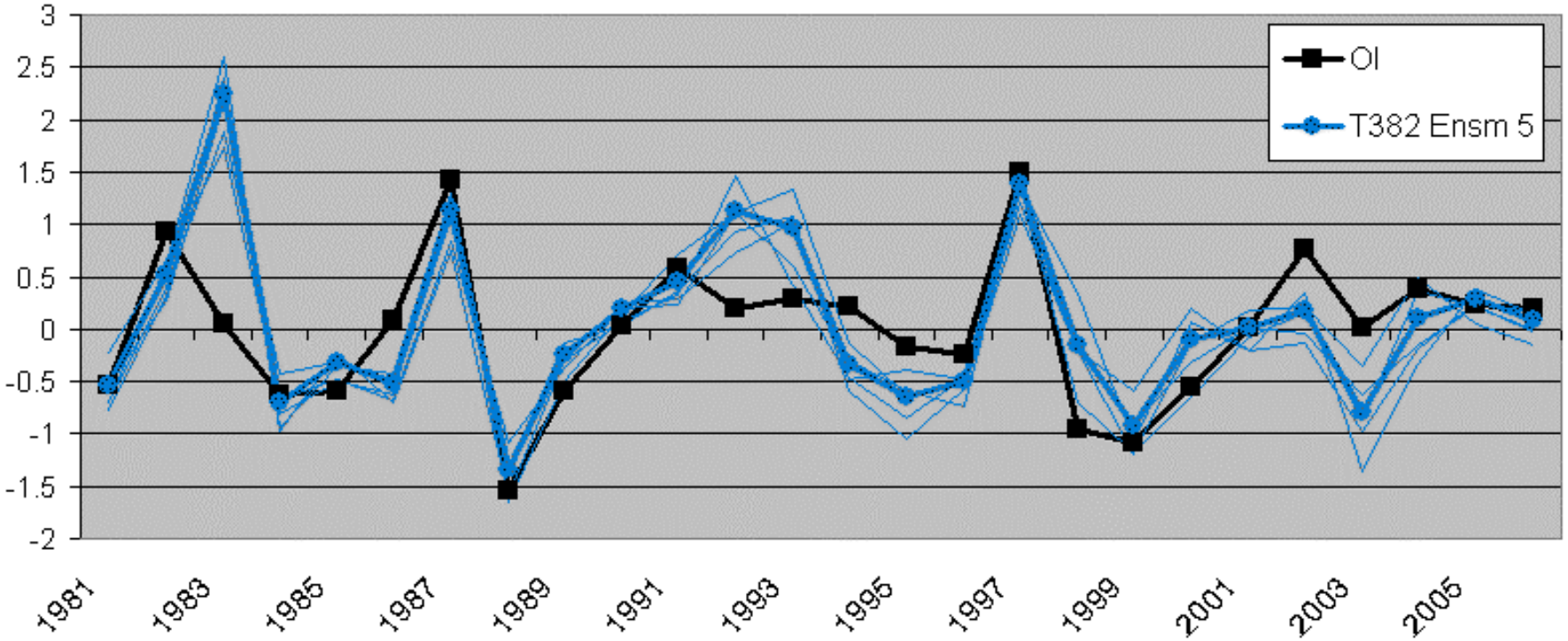


Western Pacific Basin





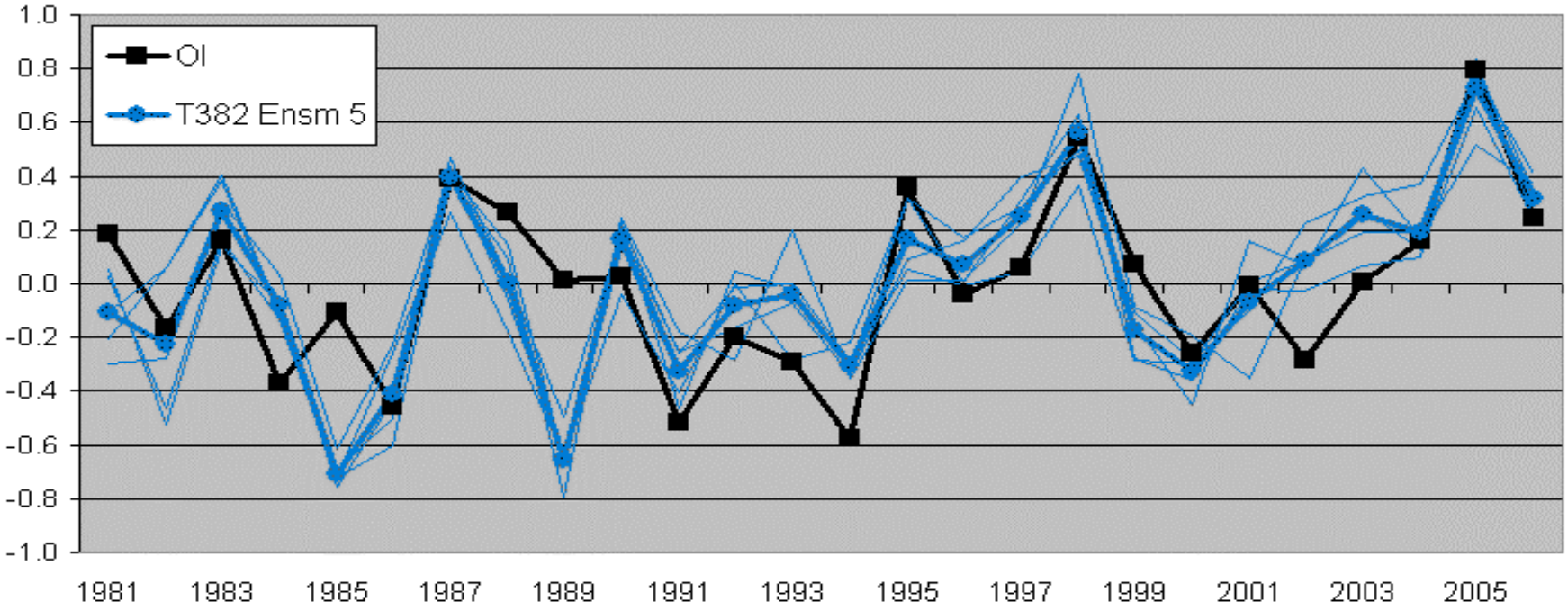
JJA Nino 3.4 SST Index



T382	Correlations
IC=0419	0.72
IC=0420	0.67
IC=0421	0.68
IC=0422	0.57
IC=0423	0.64
April Ensm 5	0.68

Red = Statistically Significant at 0.95

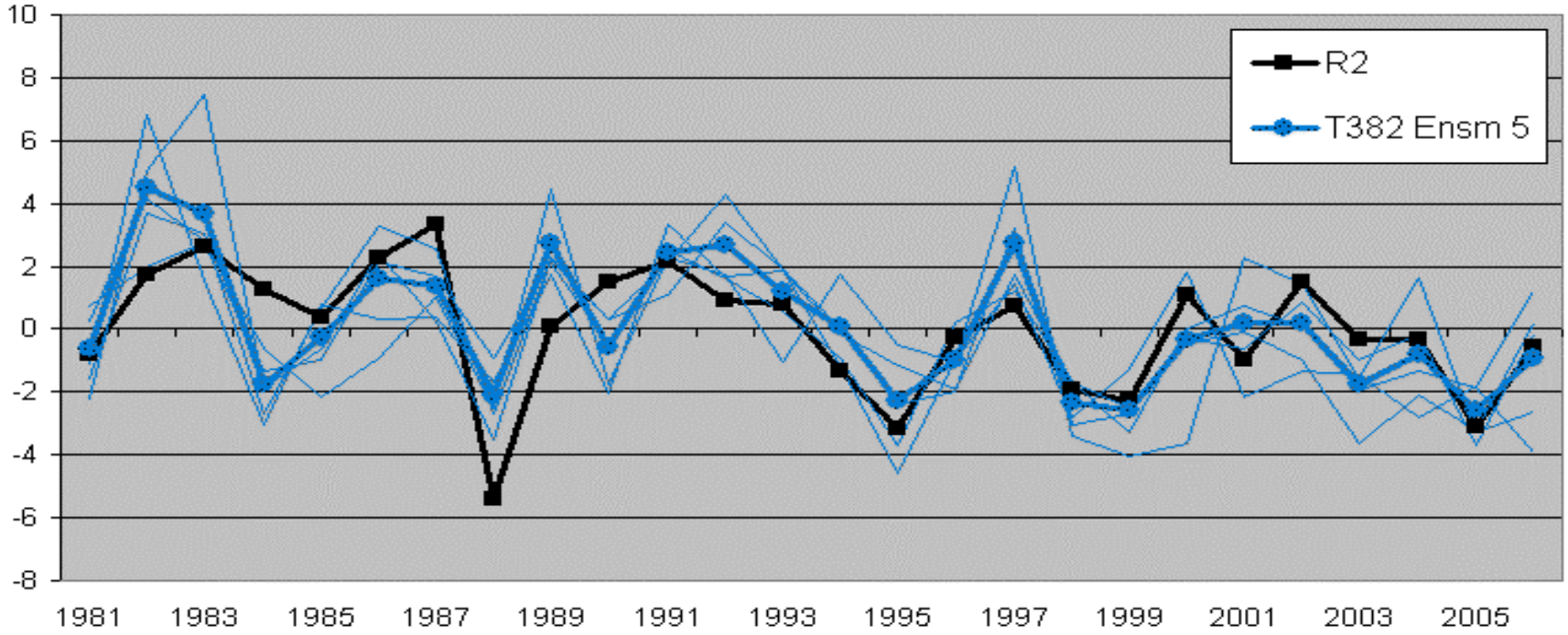
JJA Atlantic MDR SST Index



T382	Correlations
IC=0419	0.63
IC=0420	0.64
IC=0421	0.73
IC=0422	0.67
IC=0423	0.67
April Ensm 5	0.71

Red = Statistically Significant at 0.95

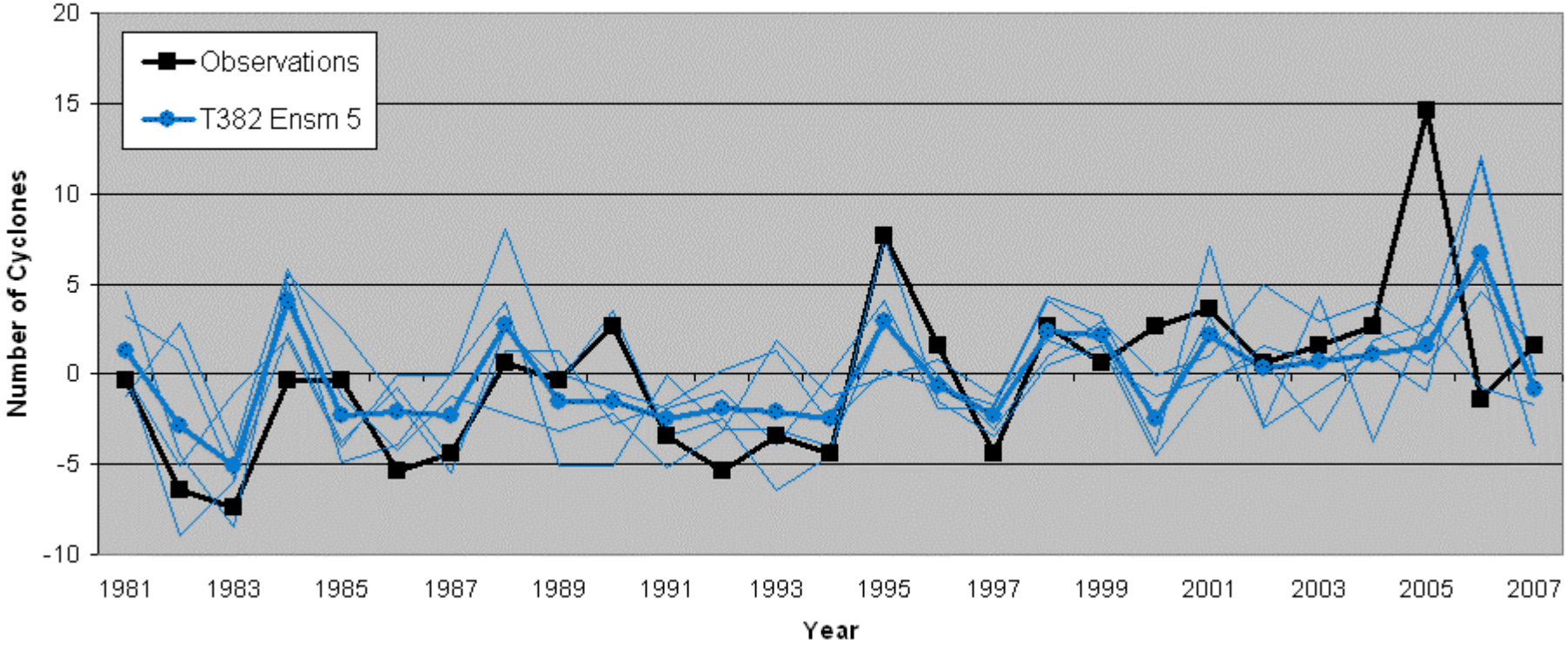
JJA Atlantic MDR Shear Index



T382	Correlations
IC=0419	0.43
IC=0420	0.54
IC=0421	0.66
IC=0422	0.68
IC=0423	0.69
April Ensm 5	0.70

Red = Statistically Significant at 0.95

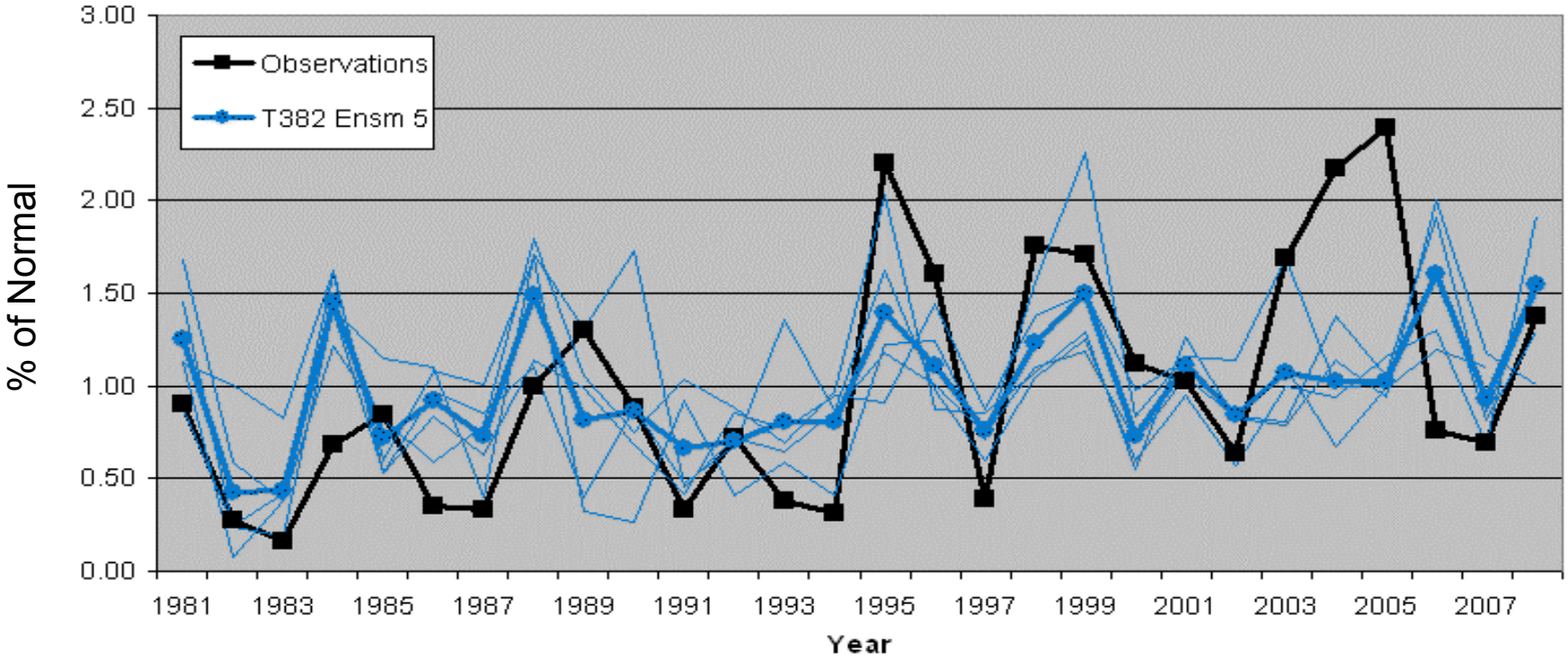
Anomalous Number of TC: Atlantic Basin



Correlations	Total
IC=0419	**0.44**
IC=0420	0.33
IC=0421	**0.35**
IC=0422	**0.43**
IC=0423	**0.54**
April Ensm 5	**0.61**

Red = Statistically Significant at 0.95

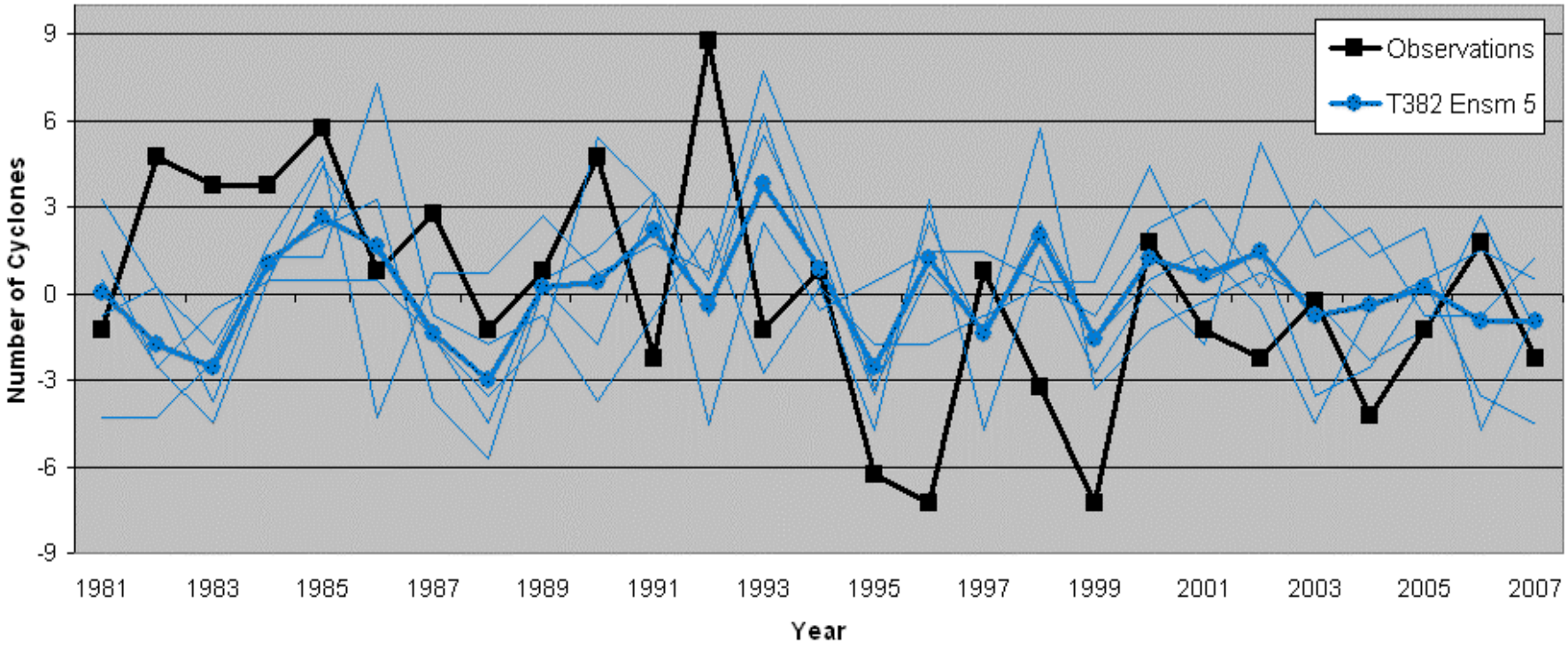
Atlantic Basin ACE Index



Correlations	Total
IC=0419	**0.47**
IC=0420	**0.58**
IC=0421	0.28
IC=0422	**0.49**
IC=0423	**0.59**
April Ensm 5	**0.62**

Red = Statistically Significant at 0.95

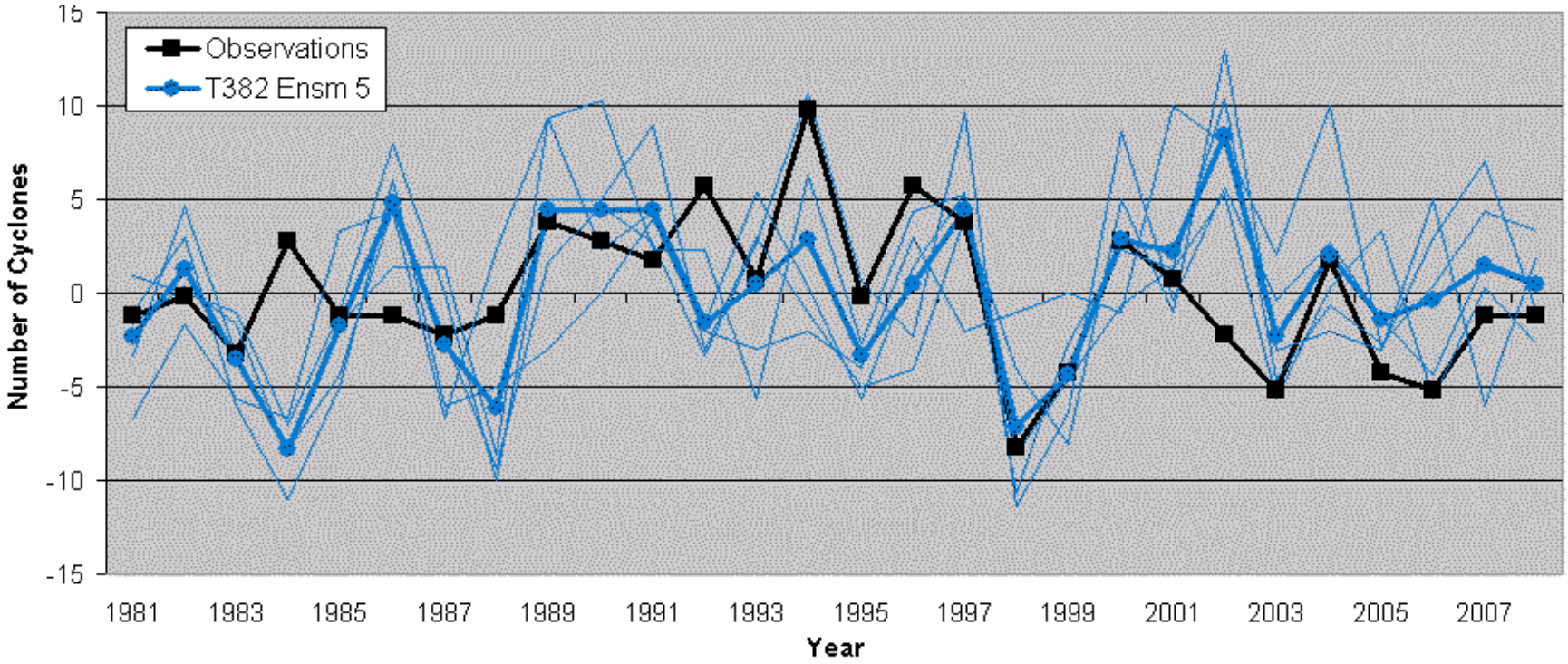
Anomalous Number of TC: Eastern N. Pacific



Correlations	Total
IC=0419	-0.04
IC=0420	-0.03
IC=0421	-0.02
IC=0422	0.15
IC=0423	-0.07
April Ensm 5	-0.04

Red = Statistically Significant at 0.95

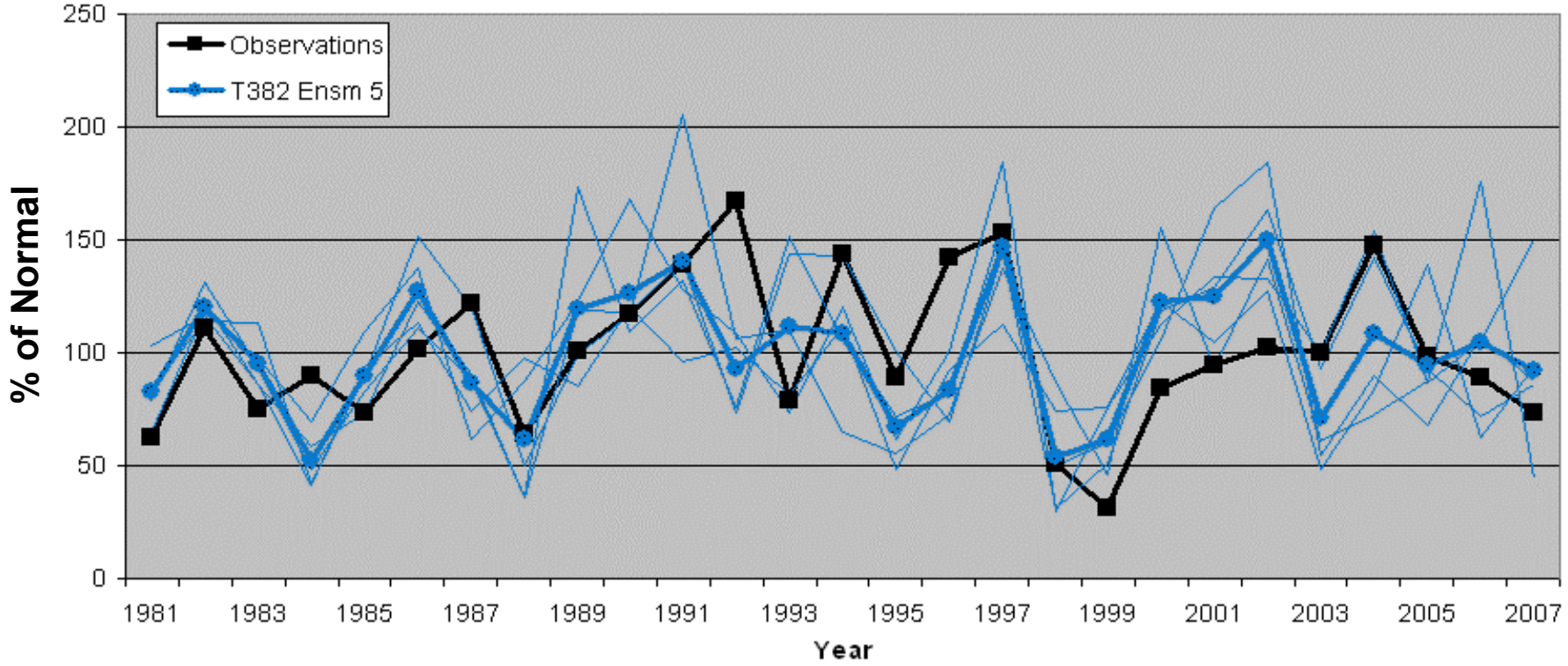
Anomalous Number of TC: Western N. Pacific



Correlations	Total
IC=0419	**0.40**
IC=0420	**0.47**
IC=0421	0.01
IC=0422	**0.53**
IC=0423	0.14
April Ensm 5	**0.46**

Red = Statistically Significant at 0.95

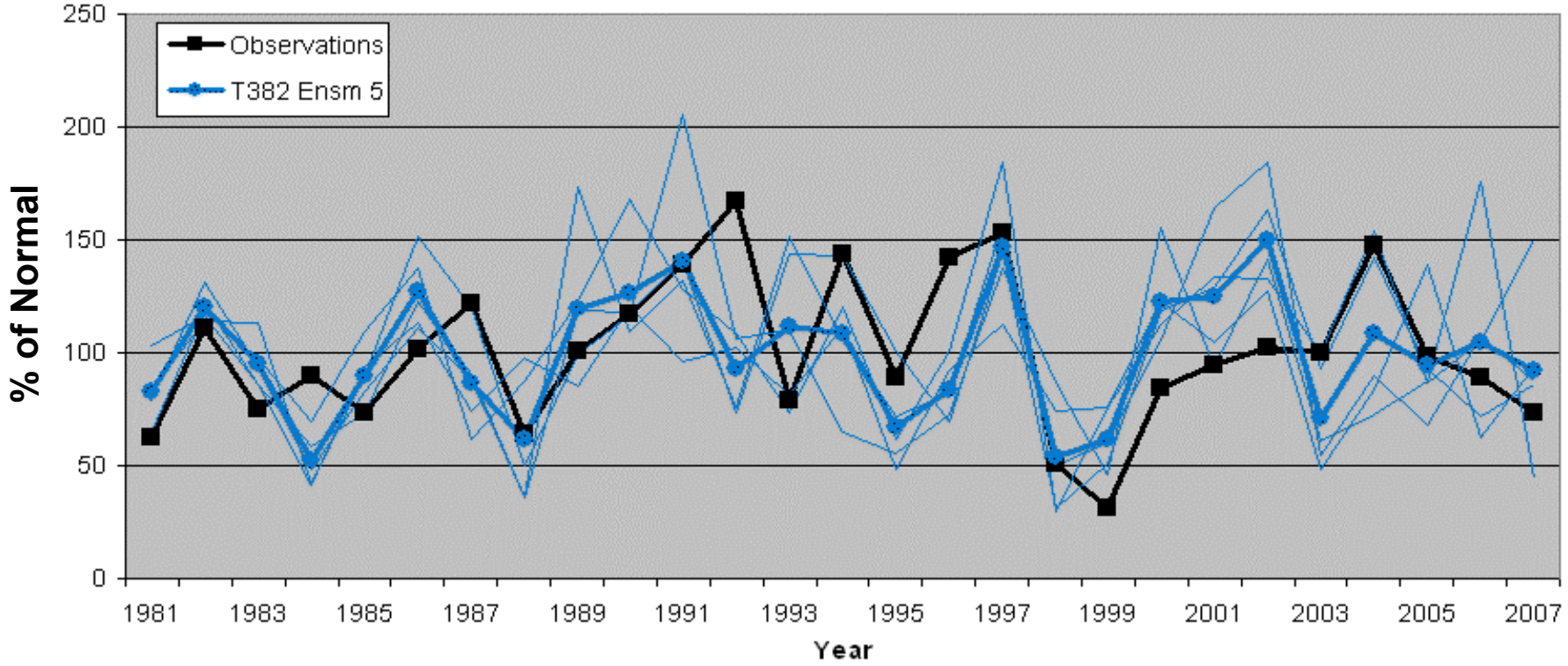
WNP Basin ACE Index



Correlations	Total
IC=0419	**0.43**
IC=0420	**0.51**
IC=0421	**0.33**
IC=0422	**0.47**
IC=0423	**0.34**
April Ensm 5	**0.50**

Red = Statistically Significant at 0.95

WNP Basin ACE Index

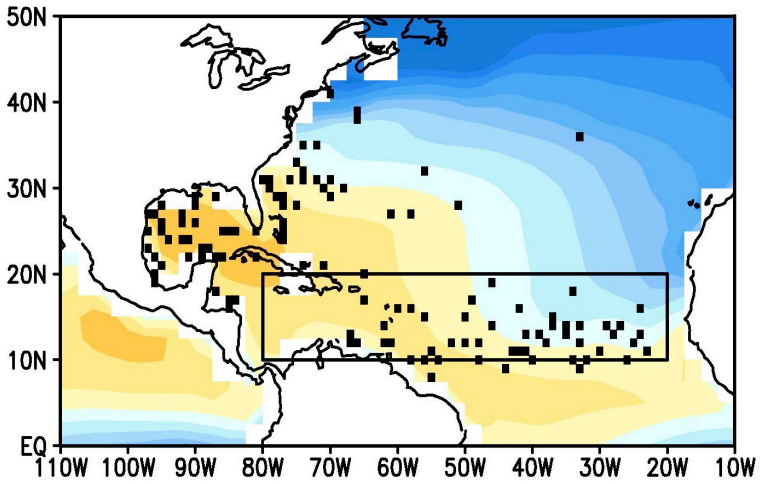


Correlations	Total
IC=0419	**0.43**
IC=0420	**0.51**
IC=0421	**0.33**
IC=0422	**0.47**
IC=0423	**0.34**
April Ensm 5	**0.50**

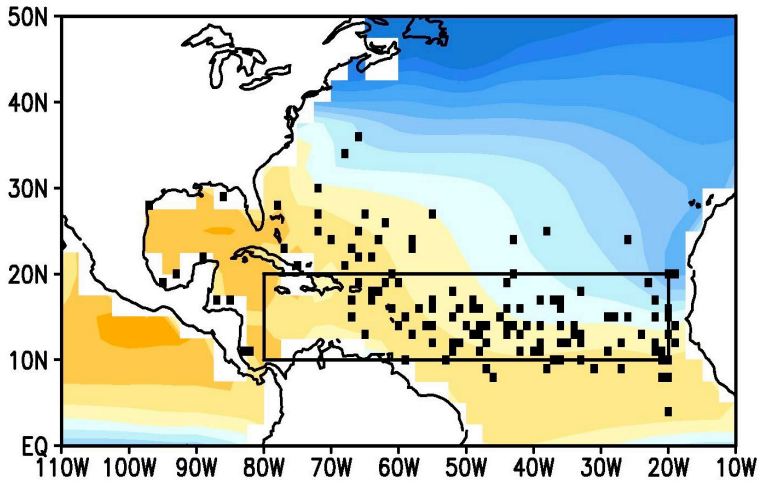
Red = Statistically Significant at 0.95

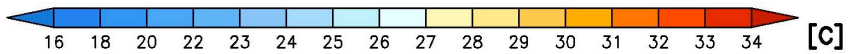
Atlantic Basin SSTs and Storm Origins Climatology JJA

a) Observed

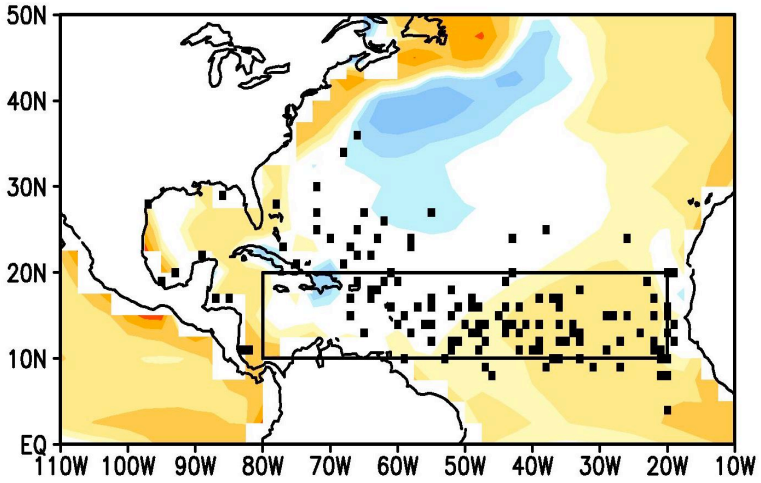


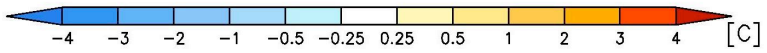
b) T382 5−Mem Ensm, IC=0423 Origins



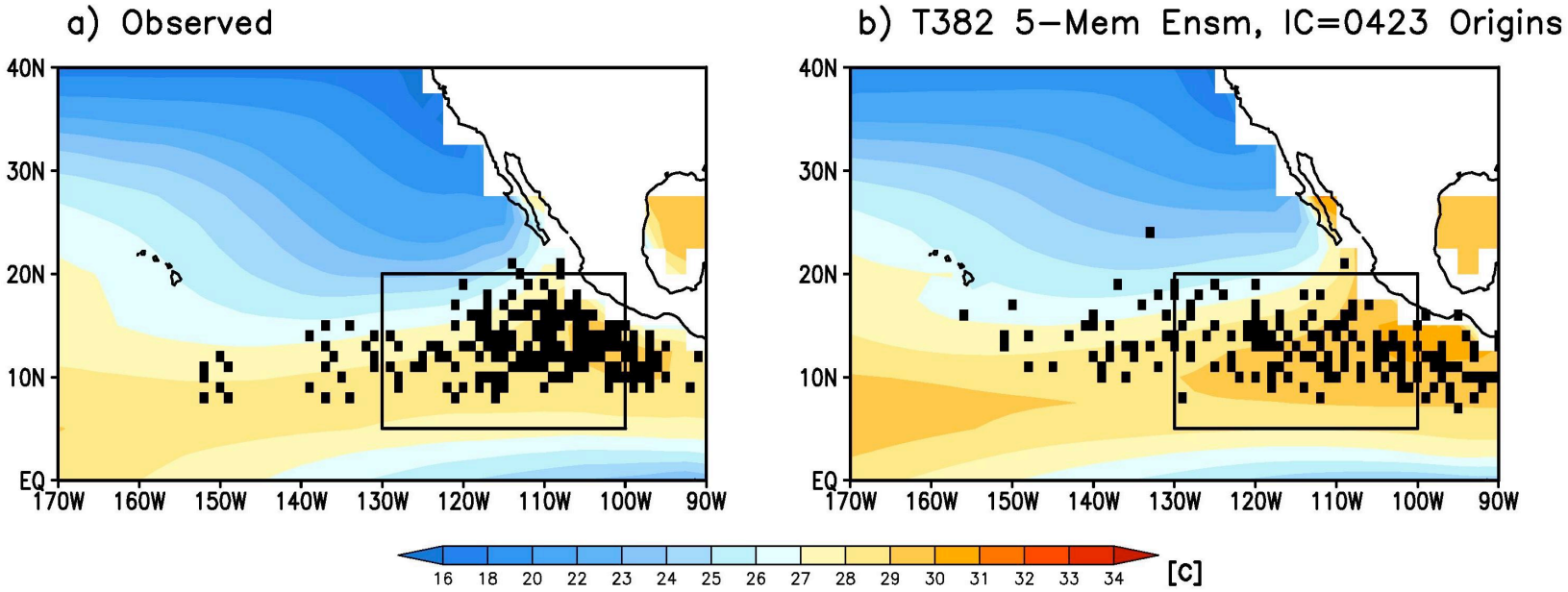


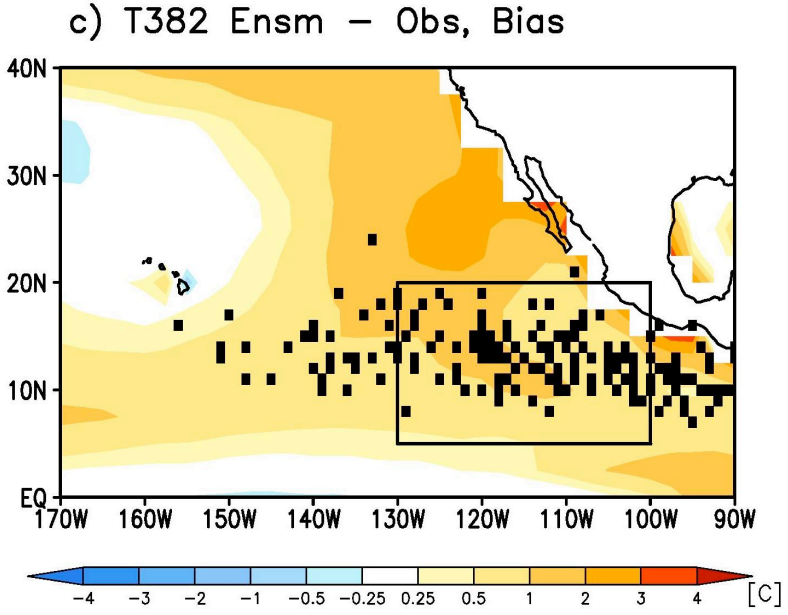
c) T382 Ensm − Obs, Bias



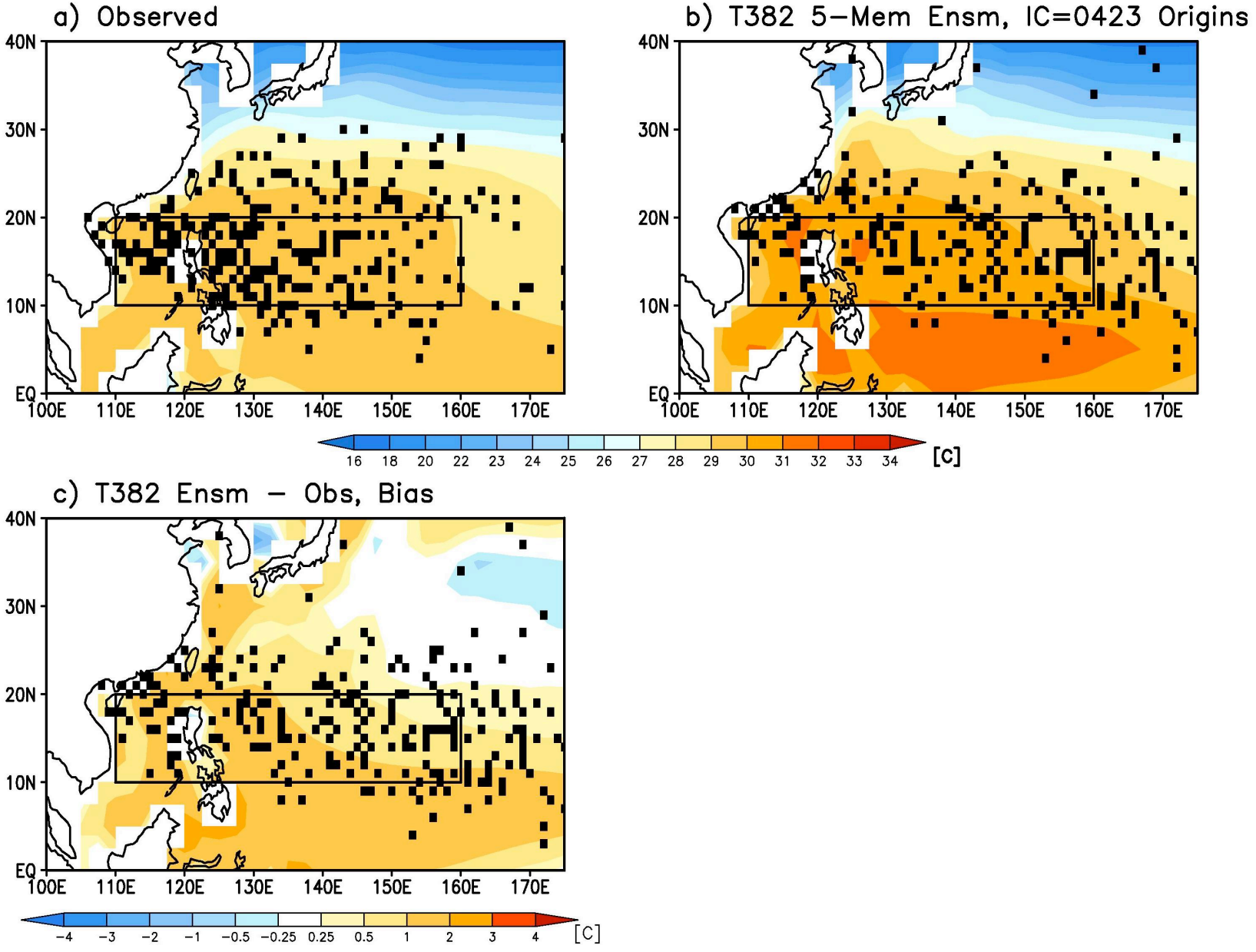


ENP SSTs and Storm Origins Climatology JJA

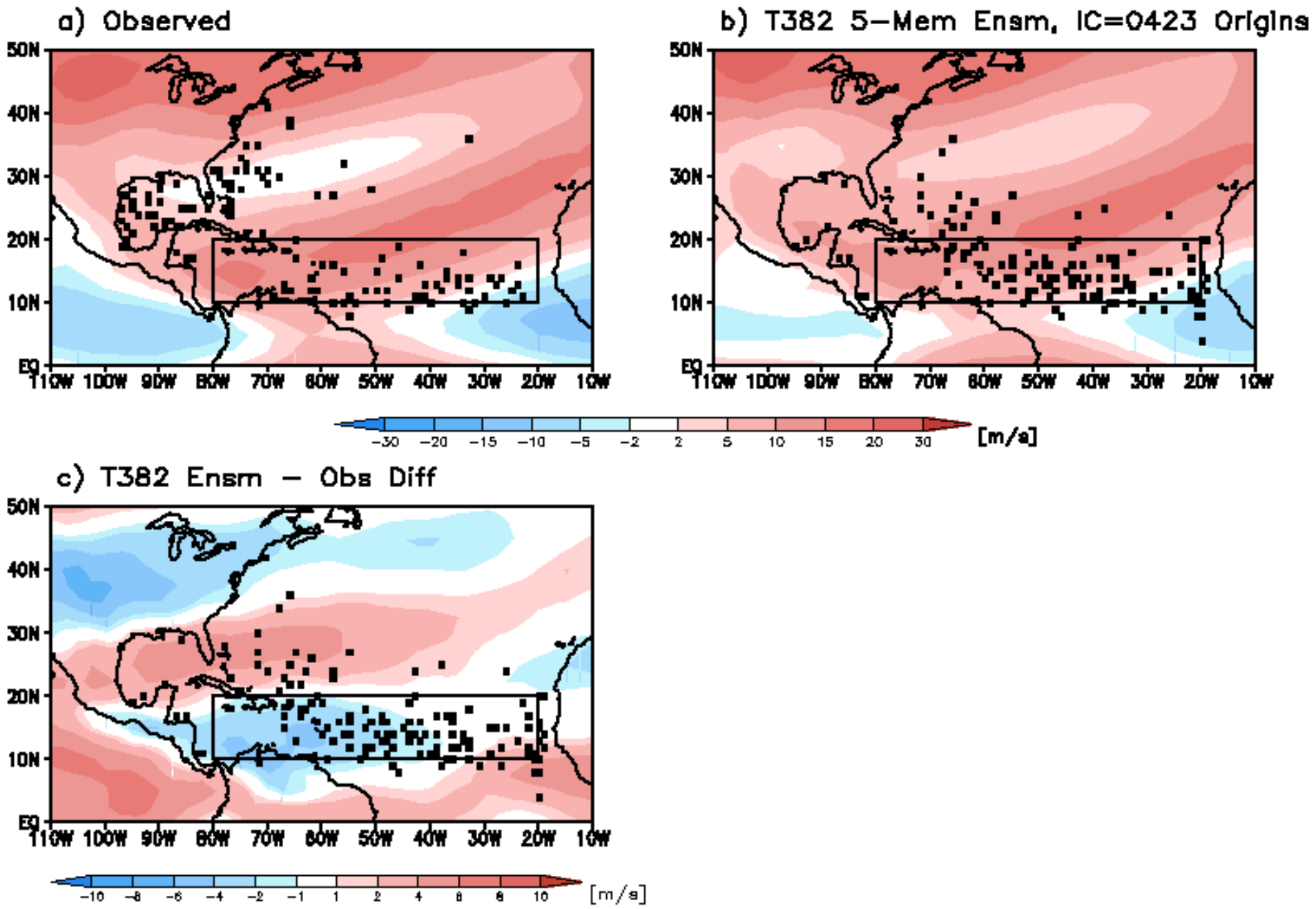




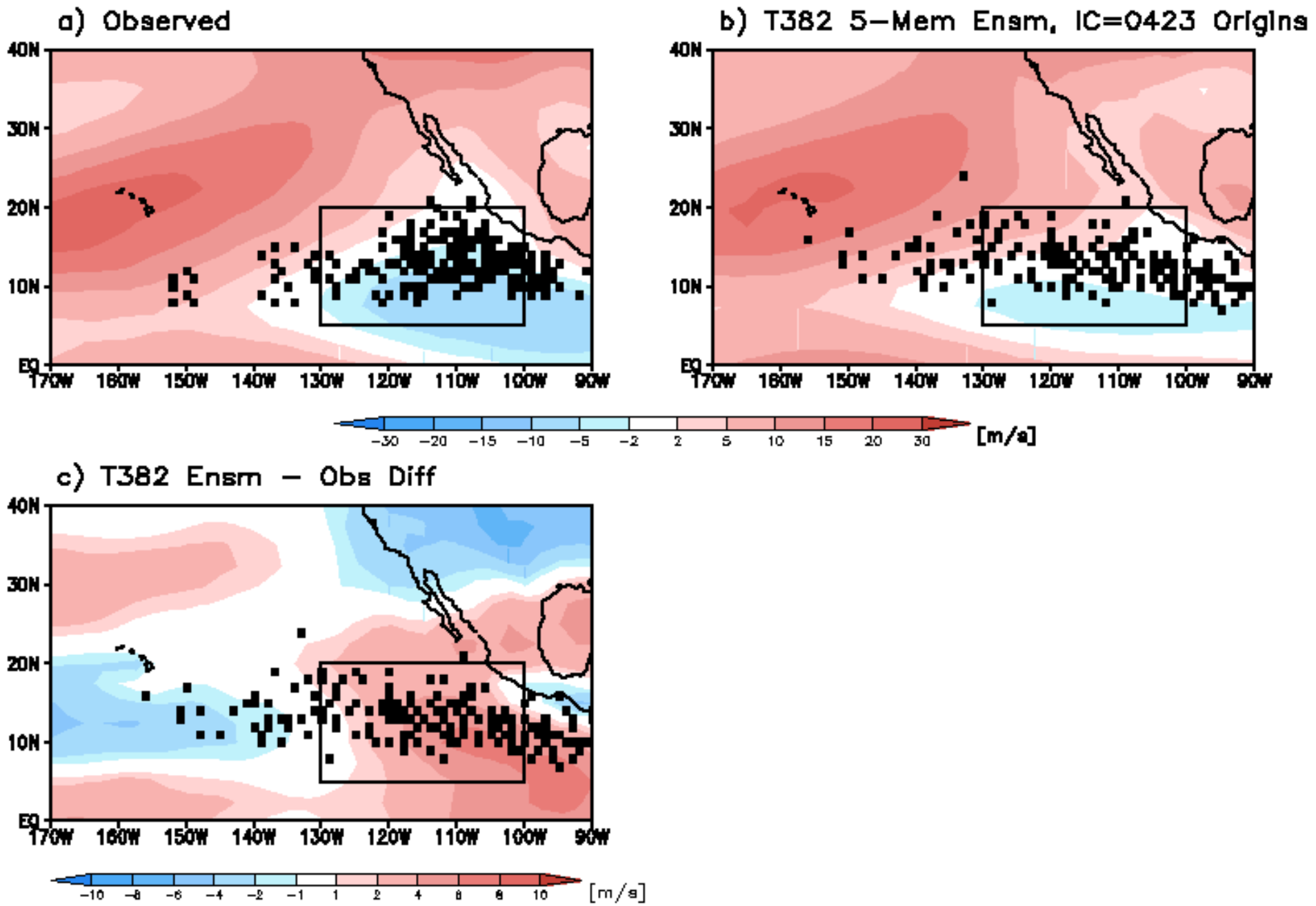
WNP SSTs and Storm Origins Climatology JJA

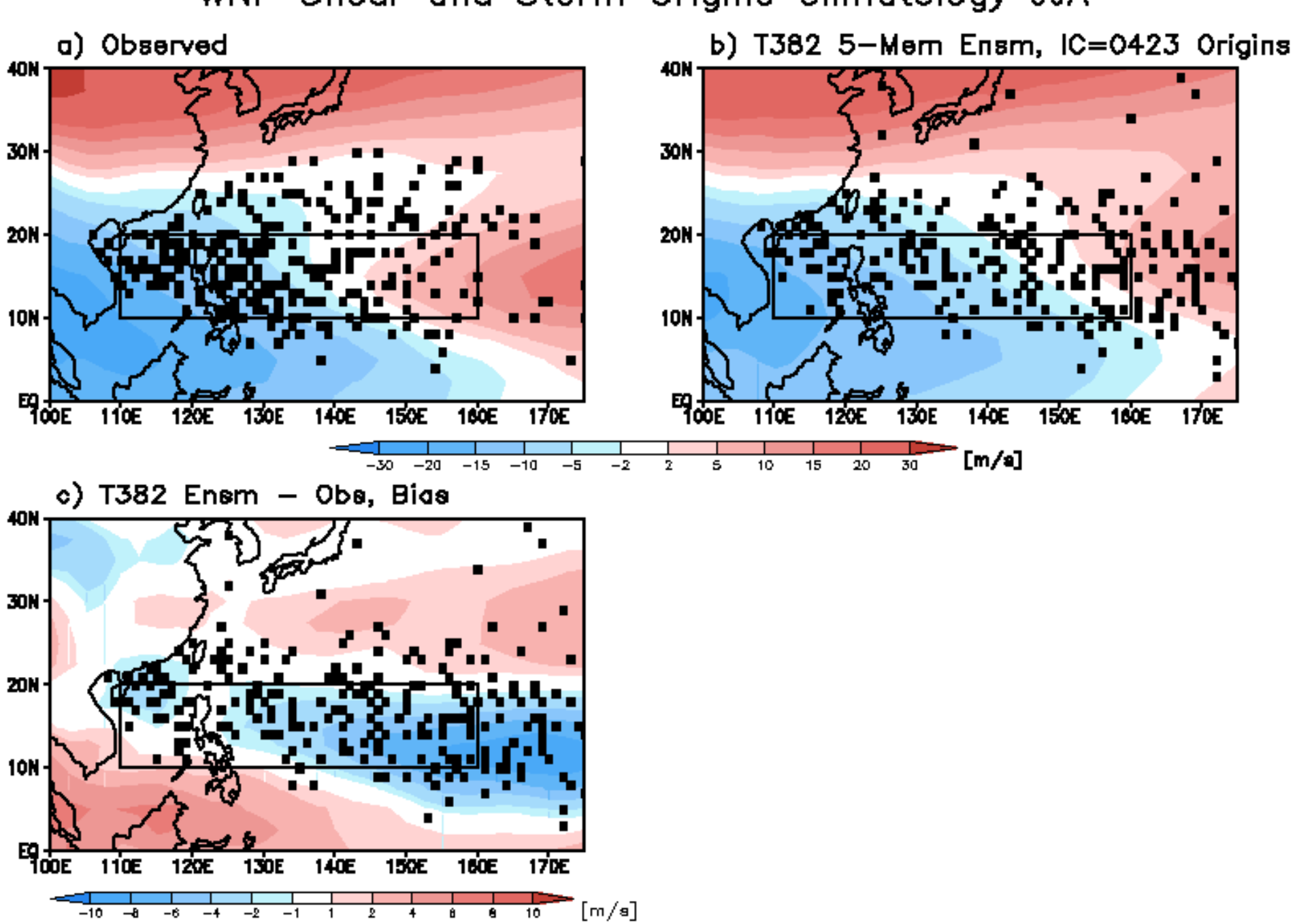


Atlantic Basin Shear and Storm Origins Climatology JJA



ENP Shear and Storm Origins Climatology JJA




WNP Shear and Storm Origins Climatology JJA
a) Observed
b) T382 5-Mem Ensm, IC=0423 Origins
c) T382 Ensm - Obs, Bias
40N
30N
20N
10N
EQ
100E
110E
120E
130E
140E
150E
160E
170E
-30 -20 -15 -10 -5 -2 2 5 10 15 20 30
[m/s]
-10 -8 -6 -4 -2 -1 1 2 4 6 8 10
[m/s]

Summary

- CFS in T382 resolution exhibits robust climatological seasonal cycle of tropical cyclones over three NH basins.
- Warming trend and intensification of hurricane activity in the Atlantic basin captured in the CFS hindcasts.
- Fair level of skill in predicting interannual variability of seasonal storm activities for the Atlantic and West. N. Pacific basins.
- Further diagnostics continue.
- Provided input for the 2009 CPC Hurricane Season Outlook with real time prediction runs.
- Impending completion of the NCEP CFS Reanalysis will provide more compatible initial conditions for future evaluation.